

REMARKS

Applicants appreciate the thoroughness with which the Examiner has examined the above-identified application. Reconsideration is requested in view of the amendments above and the remarks below.

Rejections under 35 U.S.C. § 103

Claims 1-5 stand rejected under 35 U.S.C. § 103(a) as being obvious from Jang (U.S. Patent No. 6,096,649), in view of Shibata (U.S. Patent No. 6,734,556). Applicants respectfully traverse this rejection.

In the present invention, the melting point of the alloy is greater than that of the solder bumps used for the package. Specification, p.8, ll.28-29. Importantly, the gold (Au) metal material comes from the wire itself. An alloy is not created until the Au wire is in contact with the alloying metal under temperature, pressure, and energy lower than that required for bonds that are not exposed to alloy material. Specification, p.9, ll.16-19.

Jang teaches a process sequence used to form a gold wire bond to an extended aluminum base structure, which overlays a copper damascene structure. The copper damascene structure is formed on an insulator layer. Jang uses the aluminum base structure as an intermediate structure between the gold wire and the copper damascene structure.

After removal of photoresist shape 8, via plasma oxygen ashing and careful wet cleans, gold wire 10, is bonded to the region of aluminum based structure 4b, overlaid with barrier layer 11, exposed in opening 9.
Jang, col. 4., ll.29-33; Fig. 5.

Jang's thin barrier layers about the aluminum base structure are formed of titanium nitride. Jang, col. 4, ll.1-7. Jang does not teach, disclose, or suggest forming an alloying

material of an alloying metal in combination with the metallic wire material to create a low temperature, alloy bond. Jang attaches a gold wire 10 to the thin barrier TiN layer 11, which protects and adheres to an aluminum based layer 4a. Jang, Fig. 5. There is no suggestion in Jang to introduce an alloy material to the thin barrier layer in order to form an alloy with the gold wire. Nor is there any suggestion or teaching to remove the TiN barrier layer in order to attach a gold metal wire with an alloying material on the aluminum base.

Insomuch as there is no suggestion to combine Jang with a feature of the present invention, the combination of Jang and Shibata is not an obvious construction.

The Examiner cites Shibata for support teaching certain aspects of the present invention. Applicants respectfully disagree.

Shibata teaches a bump electrode of a first semiconductor chip joined to a bump electrode of a second semiconductor chip, where both bump electrodes are made of a first metal, typically Au. Importantly, in each of the Shibata embodiments, the bump electrodes are made of the same "first metal" material. Shibata, col. 3, ll.39-46. The Au from *both* bump electrodes contributes to forming an alloy bond when the two bump electrodes are joined. "[T]he Sn coating 11a may melt to form an eutectic with Au of the bump electrodes 11 and 21, thus forming the alloy layer 3." Shibata, col. 8, ll.47-49 (emphasis added). "The respective bump electrodes 11 and 21 of these first and second semiconductor chips 1 and 2 are both made of first metal such as Au having a relatively high melting point, while a joining portion between these bump electrodes 11 and 21 is formed of an alloy layer 3 given by alloying the first metal and second metal . . ." Shibata, col. 7, ll.19-26. Shibata requires that the alloy layer be formed from the combination of the Sn layer alloying with the Au from each of the bump electrodes. Shibata, Figs. 2a, 3, 4a, 4b, 12, and 13.

In the present invention, the metallic wire and the metallic interconnect, described in claim 1, do not have to be the same material, and typically are not the same material. There is no requirement to have the Au concentration of the alloy layer be contributed from both the metallic wire and the metallic interconnect. In the present invention, only the metallic wire metal (Au) contributes to the alloy. Where Shibata teaches a combined contribution of Au from both electrode bumps to the alloy layer, the present invention does not require this construction. Moreover, claim 3 specifically requires the Au material for the alloy layer to come from the metallic wire. Shibata does not teach a metallic wire, nor that the Au material may only come from one electrode of the joining pair.

Applicants respectfully submit that claims 1 and 3 distinguish the present invention over the cited prior art of Jang in view of Shibata.

Applicants have further added new claim 21 to specifically delineate that the metallic wire and metallic interconnect are not formed of the same material for contributing to the alloy layer.

It is respectfully submitted that the application has now been brought into a condition where allowance of the entire case is proper. Reconsideration and issuance of a notice of allowance are respectfully solicited.

Respectfully submitted,



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